General

Guideline Title

Evidence-based guideline: neuromuscular ultrasound for the diagnosis of carpal tunnel syndrome.

Bibliographic Source(s)

Cartwright MS, Hobson-Webb LD, Boon AJ, Alter KE, Hunt CH, Flores VH, Werner RA, Shook SJ, Thomas TD, Primack SJ, Walker FO. Evidence-based guideline: neuromuscular ultrasound for the diagnosis of carpal tunnel syndrome. Muscle Nerve. 2012 Aug;46(2):287-93. [73 references] PubMed

Guideline Status

This is the current release of the guideline.

Recommendations

Major Recommendations

Definitions of the classification of the evidence (Class I-IV) and the levels of the recommendations (A,B, C, U) are provided at the end of the "Major Recommendations" field.

Accuracy of Neuromuscular Ultrasound

Conclusion. Based on consistent Class I and Class II evidence, neuromuscular ultrasound measurement of median nerve cross-sectional area at the wrist is established as accurate for the diagnosis of carpal tunnel syndrome (CTS).

Recommendation. If available, neuromuscular ultrasound measurement of median nerve cross-sectional area at the wrist may be offered as an accurate diagnostic test for CTS (Level A).

Clinical Context. As is the case with all ultrasonographic imaging, neuromuscular ultrasound of the median nerve at the wrist should be performed and interpreted by clinicians experienced with the technique. Scanning protocols and reference values for median nerve cross-sectional area at the wrist should be established by each laboratory prior to using neuromuscular ultrasound for the diagnosis of CTS.

Added Value of Neuromuscular Ultrasound

Conclusion. Based on Class II evidence, neuromuscular ultrasound of the wrist probably adds value to electrodiagnostic studies when assessing CTS as it can detect structural abnormalities.

Recommendation: If available, neuromuscular ultrasound should be considered to screen for structural abnormalities at the wrist in those with CTS (Level B).

Clinical Context. Screening for structural abnormalities at the wrist that cause CTS is likely to be of higher yield in those with atypical CTS. This was demonstrated by a study which found a high rate of occult ganglia only in those with unilateral CTS. This is an atypical presentation, as most patients have bilateral CTS (defined by symptoms, nerve conduction studies, or both). Other atypical presentations of CTS include sudden onset and onset in the setting of trauma. Although ultrasound can identify structural abnormalities, it is possible these abnormalities may not always be the underlying cause of the median mononeuropathy. In addition, the prevalence of such abnormalities in the general population is not known, so the sensitivity and specificity of ultrasound for the identification of these structures cannot be calculated based on currently available data. The wide prevalence range for bifid median nerves (2%–13%) may be secondary to ultrasound device resolution (earlier studies identified fewer bifid nerves), ultrasound technique and site of imaging within the wrist, or patient population. The presence of structures such as persistent median arteries and accessory muscles is clearly of therapeutic interest, as it may alter the choice of interventional approach (either injection or surgery). Knowledge of a bifid median nerve and other anatomic variants is also of interest in planning the treatment of CTS, and identification of such variants prior to invasive intervention can even assist later in the assessment of failed intervention. In addition, the presence of a bifid median nerve may be an independent risk factor for the development of CTS.

Clinical Context Summary for All Evidence

A single neuromuscular ultrasound evaluation of the wrist in those with CTS allows for assessment of both median nerve cross-sectional area and the presence of structural abnormalities, and this complements well the information obtained during an electrodiagnostic study (which is the gold standard for diagnosis of CTS). Some variability exists in the devices, scanning protocols, and reference ranges for the diagnosis of CTS when using neuromuscular ultrasound, but this is to be expected. As a comparison, similar variability exists in electrodiagnostic techniques. It is anticipated that with continued experience with neuromuscular ultrasound techniques, more uniformity will occur as consensus develops regarding optimal use of the technology. It should also be noted that many studies have proposed other neuromuscular ultrasound parameters that can be used to assist in the diagnosis of CTS, but these were not assessed in this guideline. These include median nerve flattening ratios; measures of median nerve mobility, echogenicity, and vascularity; and measures of flexor retinaculum bowing.

Definitions:

American Academy of Neurology (AAN) Classification of the Evidence for Rating of a Diagnostic Article

Class I: A cohort study with prospective data collection of a broad spectrum of persons with the suspected condition, using an acceptable reference standard for case definition. The diagnostic test is objective or performed and interpreted without knowledge of the patient's clinical status. Study results allow calculation of measures of diagnostic accuracy.

Class II: A case–control study of a broad spectrum of persons with the condition established by an acceptable reference standard compared with a broad spectrum of controls, or a cohort study with a broad spectrum of persons with the suspected condition where the data were collected retrospectively. The diagnostic test is objective or performed and interpreted without knowledge of disease status. Study results allow calculation of measures of diagnostic accuracy.

Class III: A case–control study or cohort study where either persons with the condition or controls are of a narrow spectrum. The condition is established by an acceptable reference standard. The reference standard and diagnostic test are objective or performed and interpreted by different observers. Study results allow calculation of measures of diagnostic accuracy.

Class IV: Studies not meeting Class I, II, or III criteria, including consensus, expert opinion, or a case report.

American Academy of Neurology (AAN) Classification of the Evidence for Rating of a Screening Article

Class I: A statistical, population-based sample of patients studied at a uniform point in time (usually early) during the course of the condition. All patients undergo the intervention of interest. The outcome, if not objective, is determined in an evaluation that is masked to the patients' clinical presentations.

Class II: A statistical, non-referral clinic-based sample of patients studied at a uniform point in time (usually early) during the course of the condition. Most patients undergo the intervention of interest. The outcome, if not objective, is determined in an evaluation that is masked to the patients' clinical presentations.

Class III: A sample of patients studied during the course of the condition. Some patients undergo the intervention of interest. The outcome, if not objective, is determined in an evaluation by someone other than the treating physician.

Class IV: Studies not meeting Class I, II, or III criteria, including consensus, expert opinion, or a case report.

Classification of Recommendations

The four possible recommendation classifications include:

Level A = Established as effective, ineffective, or harmful (or established as useful/predictive or not useful/predictive) for the given condition in specified population. (Level A rating requires at least two consistent Class I studies.) [In exceptional cases, one convincing Class I study may suffice for an "A" recommendation if: (1) all criteria are met; and (2) the magnitude of effect is large (relative rate improved outcome >5 and the lower limit of the confidence interval is >2.]

Level B = Probably effective, ineffective, or harmful (or probably useful/predictive or not useful/predictive) for the given condition in the specified population. (Level B rating requires at least one Class I study or two consistent Class II studies.)

Level C = Possibly effective, ineffective, or harmful (or possibly useful/predictive or not useful/predictive) for the given condition in the specified population. (Level C rating requires at least one Class II study or two consistent Class III studies.)

Level U = Data inadequate or conflicting; given current knowledge, treatment (test, predictor) is unproven.

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Carpal tunnel syndrome

Guideline Category

Diagnosis

Evaluation

Screening

Clinical Specialty

Family Practice

Internal Medicine

Neurological Surgery

Neurology

Orthopedic Surgery

Physical Medicine and Rehabilitation

Plastic Surgery

Radiology

Surgery

Intended Users

Physicians

Guideline Objective(s)

To provide an evidence-based guideline for the use of neuromuscular ultrasound in the diagnosis of carpal tunnel syndrome

Target Population

Patients with suspected carpal tunnel syndrome

Interventions and Practices Considered

1. Neuromuscular ultrasound measurement of median nerve cross-sectional area at the wrist
2. Use of neuromuscular ultrasound to screen for structural abnormalities at the wrist

Major Outcomes Considered

- Accuracy, sensitivity, and specificity of neuromuscular ultrasound for the diagnosis of carpal tunnel syndrome
- Added value of neuromuscular ultrasound in the diagnosis of carpal tunnel syndrome

Methodology

Methods Used to Collect/Select the Evidence

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

In May 2011, PubMed was used to search Medline to identify all potential abstracts. The search terms "carpal tunnel syndrome OR median nerve OR median neuropathy" were combined with the terms "ultrasound OR ultrasonography OR sonogram OR sonography." This produced 724 articles from 1990 to May 2011. This was narrowed to 641 articles by including "English-only" and "human-only" studies. The titles of those articles were reviewed for relevance, which yielded 240 articles, and each abstract was then reviewed by at least two investigators. This resulted in 121 articles for full manuscript review. After each article was reviewed in its entirety by two investigators, 67 were identified as relevant for this guideline. In order to be considered relevant, the article had to describe the use of ultrasound to image the wrist in individuals suspected of having carpal tunnel syndrome (CTS).

Number of Source Documents

67 articles were identified as relevant for this guideline.

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

American Academy of Neurology (AAN) Classification of the Evidence for Rating of a Diagnostic Article

Class I: A cohort study with prospective data collection of a broad spectrum of persons with the suspected condition, using an acceptable reference standard for case definition. The diagnostic test is objective or performed and interpreted without knowledge of the patient's clinical status. Study results allow calculation of measures of diagnostic accuracy.

Class II: A case–control study of a broad spectrum of persons with the condition established by an acceptable reference standard compared with a broad spectrum of controls, or a cohort study with a broad spectrum of persons with the suspected condition where the data were collected retrospectively. The diagnostic test is objective or performed and interpreted without knowledge of disease status. Study results allow calculation of measures of diagnostic accuracy.

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Class IV: Studies not meeting Class I, II, or III criteria, including consensus, expert opinion, or a case report.

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

The 67 relevant articles were rated by at least two investigators according to criteria set by the American Academy of Neurology (AAN). Articles pertaining to the accuracy of median nerve cross-sectional area measurements for the diagnosis of carpal tunnel syndrome (CTS) (45 articles) were assessed using the AAN criteria for rating an article on diagnostic accuracy, and articles pertaining to neuromuscular ultrasound as a screening tool to identify anatomic explanations for CTS were assessed using AAN criteria for rating a screening article (23 articles). One article was assessed for both diagnostic accuracy and as a screening article. See the "Rating Scheme for the Strength of Evidence" for both rating systems.

Studies with the highest levels of evidence (Class I and II) are discussed in the text of the original guideline document and summarized in the evidence tables. At each step in the process, disagreements were arbitrated by a third investigator.

Methods Used to Formulate the Recommendations

Expert Consensus

Description of Methods Used to Formulate the Recommendations

The American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM) convened an expert panel of physicians specializing in neurology, physical medicine and rehabilitation, and radiology, selected to represent a broad range of expertise related to neuromuscular ultrasound and carpal tunnel syndrome (CTS). Some panel participants reported using neuromuscular ultrasound frequently for clinical and

research purposes, and others reported never using the technology. All panel participants had expertise in the clinical and electrodiagnostic assessment of CTS.

Two questions were asked: (1) What is the accuracy of median nerve cross-sectional area enlargement as measured with ultrasound for the diagnosis of CTS? (2) What added value, if any, does neuromuscular ultrasound provide over electrodiagnostic studies alone for the diagnosis of CTS?

Rating Scheme for the Strength of the Recommendations

Classification of Recommendations

The four possible recommendation classifications include:

Level A = Established as effective, ineffective, or harmful (or established as useful/predictive or not useful/predictive) for the given condition in specified population. (Level A rating requires at least two consistent Class I studies.) [In exceptional cases, one convincing Class I study may suffice for an "A" recommendation if: (1) all criteria are met; and (2) the magnitude of effect is large (relative rate improved outcome >5 and the lower limit of the confidence interval is >2.]

Level B = Probably effective, ineffective, or harmful (or probably useful/predictive or not useful/predictive) for the given condition in the specified population. (Level B rating requires at least one Class I study or two consistent Class II studies.)

Level C = Possibly effective, ineffective, or harmful (or possibly useful/predictive or not useful/predictive) for the given condition in the specified population. (Level C rating requires at least one Class II study or two consistent Class III studies.)

Level U = Data inadequate or conflicting; given current knowledge, treatment (test, predictor) is unproven.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

The guideline was approved by the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM) Board of Directors on January 23, 2012.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

Appropriate use of neuromuscular ultrasound for the diagnosis of carpal tunnel syndrome

Potential Harms

Not stated

Qualifying Statements

Qualifying Statements

This statement has been provided as an educational service of the American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM). It is based on an assessment of current scientific and clinical information. It is not intended to include all possible proper methods of care of a particular neurological problem or all legitimate criteria for choosing to use a specific procedure. Neither is it intended to exclude any reasonable alternative methodology. The AANEM recognizes that specific patient care decisions are the prerogative of the patient and the physician caring for the patient, based on all of the circumstances involved. The clinical context section is made available in order to place the evidence-based guidelines into perspective with current practice habits and challenges. No formal practice recommendation should be inferred.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Institute of Medicine (IOM) National Healthcare Quality Report Categories

IOM Care Need

Getting Better

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

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Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2012 Aug

Guideline Developer(s)

American Association of Neuromuscular and Electrodiagnostic Medicine - Medical Specialty Society

Source(s) of Funding

American Association of Neuromuscular and Electrodiagnostic Medicine (AANEM)

Guideline Committee

Practice Issues Review Panel

Composition of Group That Authored the Guideline

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Financial Disclosures/Conflicts of Interest

Michael S. Cartwright receives funding from the National Institutes of Health/National Institute of Neurological Disorders and Stroke for neuromuscular ultrasound research and royalties from Elsevier for sales of the textbook Neuromuscular Ultrasound. Francis O. Walker receives royalties from Elsevier for sales of Neuromuscular Ultrasound.

Guideline Status

This is the current release of the guideline.

Guideline Availability

Electronic copies: Available in Portable Document Format (PDF) from the American Association of Neuromuscular and Electrodiagnostic Medicine Web site .

Availability of Companion Documents

None available

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on September 14, 2012. The information was verified by the guideline developer on September 25, 2012.

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